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Addressing the Information Systems mindshare Divide in Developing Countries

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ABSTRACT

The digital divide refers to the gap between those who benefit from the digital technologies and those who cannot. The difference in the availability and accessibility to technology and systems is quite dramatic between developed and developing countries. Current practice is to attempt to make technologies available to more people in developing countries by bolstering IT stock without addressing the underlying issues surrounding ICT illiteracy in these countries. Such an approach is only compounding the problems. More often than not, ill-suited technologies paired with systems that do not support local practices meet with minimal usage and are deemed a failure. This research paper proposes three facilitating factors – (i) Technology Exposure, (ii) Cultural Awareness and (iii) Systems Blending to increase the effectiveness of systems deployments in developing environments. The paper extends the Technology Acceptance Model (TAM) to measure the impact of each of these three factors on the system adoption outcome.

Keywords

Developing countries, Technology acceptance model, Systems adoption, Digital divide.

INTRODUCTION

The digital divide refers to the gap between those who benefit from the digital technologies and those who cannot. The contrasts in terms of information and communication technology and are quite dramatic between developed and developing countries. A UN (2001) report pointed out that in the United States and the developed countries computer saturation is over 50%, and home-based Internet connectivity averages over 50% of those households. While in most of Africa, South America, South Asia, China, Indonesia, and so on home computer ownership is 1 - 2% and Internet connectivity less than half of that. Overall, less than 5% of the world's population of nearly seven billion has gained access to the Information Age as witnessed by access to the internet.

Clearly there are severe disparities in the sheer number of IT stock across developing and developed countries; such as per capita computers, internet access and computer usage. However, a significant issue is not so much about the deployed stock of digital technology but rather about the resulting lack of IT literacy that can severely limit the benefits derived from such technologies, even when access is provided. Typically ICT's cannot deliver any benefits on their own unless that are supported and enhanced by skilled and educated human resources and appropriate institutional capacity (UNCTAD, 2005). Moreover, information system usage is influenced by different national cultures, laws, information technology infrastructure and established business practices (Dasgupta, et al., 1999). For example Donner (2007) found entrenched face-to-face interactions are still preferred by retail store owners/customers in India as a means of developing contact and gauging business opportunity, regardless of ICT availability.

The international aid agencies have often included computer literacy initiatives as part of their aid projects, but they only provide basic training which does not build long term vision, mindsets and cultures to sustain the projects after the foreign experts have left (Heeks, 2002; Braa et.al. 2001). Building literacy of ICT's involves the cultivation of new cultures of ICT use including ways of processing, analyzing and using data and systems thinking (Heeks, 2002). Cultivation is a gradual yet progressive process involving changes based on learning through experimentation, local adoption and use. Potential adopters of technological innovations are more likely to adopt the technology if they have been allowed to experiment with it and have become more comfortable with it (Tan and Teo, 2000).

Technology solution providers often ignore the developing countries and the nuances of those users and environments, when designing systems. They are ignored because market forces assume that designing targeted solutions for them is not economically attractive. Without such customizations, too often, inappropriate technologies, which are not suitable for the infrastructure in developing countries is deployed (Peters, et. al., 2006). The result is that even where the developing world is provided access to digital technology, they are low-quality and high resource consuming products and services intended for developed environments. These digital technologies are typically useless to the users and hence go unused thus perpetuating the digital divide.

Goals of this Research

The above self sustaining phenomena needs to be addressed in order for developing countries to benefit from the Information Age. The goals of this exploratory research study are to study three factors – technology exposure, cultural awareness and systems blending on the resulting systems adoption outcome in developing environments. Specifically, the three goals are to identify the following:

1. Building an understanding of the factors leading to the "mindshare" divide for ICT in developing countries.
2. Describing three factors that can effectively help alleviate the "mindshare" divide.
3. Developing a research model that is an extension of TAM to measure the contribution of each of the three factors on system adoption intentions of users in developing countries.

FACTORS LEADING TO THE "*MINDSHARE*" DIVIDE

The ramification of the major differences in the availability and accessibility to IT stock in developing vs. developed countries is leading to an information systems **"mindshare divide"**. This is the result of a lack of interaction/exposure of the population in developing countries with information and communication technology (ICT) from an early age. People who have never seen or touched ICT's have little understanding of how they might benefit from such devices and systems. Unlike in the developed world, where even school children play computer games, carry portable game controllers and cell phones, this is not the case in the developing world. This causes a "*reverse network effect*" where due to financial constraints and limited ICT adoption, a sufficiently large pool of users do not exist to entice systems developers to produce systems targeting these populations. The international disparity in access to ICTs is a major gap between rich and poor nations. But the ICT "mindshare" divide in large swaths of the developing world continues to perpetuate and widen this already great gulf (Bhatnagar and Schware, 2000).

From the above arguments, the reason why the digital divide between nations is increasing seems very clear. If widespread access to ICTs gives a nation an advantage and lack of access leaves it at a disadvantage (Mbarika, et. al., 2002). The international disparity in access to ICTs is a major disparity between rich and poor nations. But the "mindshare" divide in information and communication technology (ICT) in large swaths of the developing world continues to perpetuate and in fact, widens this already great gulf

The main factors that create and sustain the "mindshare" divide are:

Computer Illiteracy

The computer illiteracy is a major environmental challenge in implementing information systems in developing countries. Large sections of the population in developing countries have not seen a computer or its use. They have no knowledge of the terminology, or how to interact with a computer. Not only is there a critical shortage of ICT skills, the opportunities for exposure and training are limited as well (Dada, 2006). Therefore, how can they even imagine how such a device can be benefitial to their livelihood? ICT's can have a positive role in development of backward regions. However, simply introducing complex, expensive ICT equipment and infrastructure without taking care of addressing the underlying computer illiteracy, only promotes the mindshare divide and merely reflects the irrational bias that ICT's possess some magical powers only perpetuates the same state of affairs.

Deployment of technology without adjusting for the poor infrastructure.

Other factors contributing to the "mindshare"divide, include the adoption of expensive imported equipment that does not work adequately in environments where there is heat, dust, humidity, no air conditioning and a shortage of electrical power. Equipment malfunction is a major problem in such environments. Systems need to account for rough conditions and not be designed with components that have low tolerance to environmental variables that can fail. For example Bhatnagar and

Schware (2000) describe how some expensive, high quality, imported and totally automated equipment to measure butterfat content in milk at collection centers in India functioned poorly in Indian conditions. As a result, they were replaced with local made computer-based assessing equipment that was less sophisticated, less expensive, partially automated and requiring some human intervention, which nonetheless produced accurate butterfat readings in a few minutes. The later accounted for the local environment and functioned better in those conditions.

Systems being designed and built without Local Input

ICT projects must build on an assessment of local needs, as locally defined by local people. Local language and local content are essential. In reality, systems from the developed world are deployed wholesale into the developing countries. Often, however, these projects are not based on any real assessment of local needs. Furthermore, they assume a uniformity of needs in distinct localities with different populations, economic bases, cultures, social organization, and levels of need. Finally, they take for granted that providing computers and/or Web connections will (without additional efforts) provide increased social justice, enable local peoples to sell their products in the world market, feed the hungry, meet unmet medical needs, and so on (Keniston and Kumar, 2004).

The phenomenon is illustrated in Figure 1.

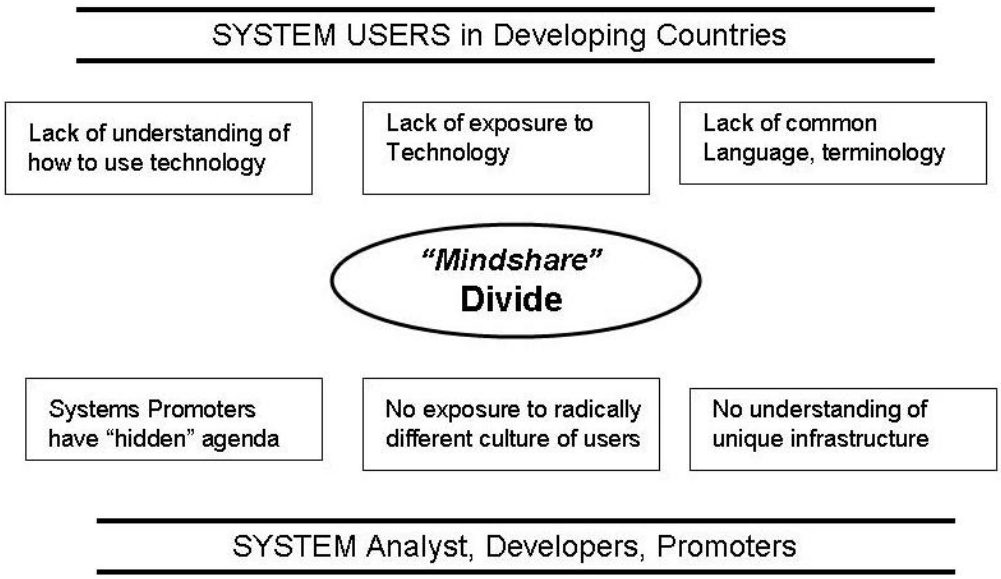

Figure 1: Categorizing the IS "Mindshare" divide for Developing Countries

THREE FACTORS TO BRIDGE THE "MINDSHARE" DIVIDE

Information systems that are essential for data collection, analysis, information dissemination, and use are rarely available in low-income developing countries due to years of under-investment (Chetley, 2006). ICT's that have been tried and tested in developed countries could however play a role in developing countries in improving several aspects of life, but only if the "mindshare" divide can be addressed first. The following three factors can play a role in addressing the "mindshare" divide.

Technology Exposure

Exposure to technology, particularly at formative ages of human development is severely lacking in developing regions. The availability and accessibility to computer and communication technology such as internet connectivity is significantly lower in the developing countries. The resultant computer illiteracy is a major environmental challenge in implementing information systems in developing countries. There is practically no exposure to user interfaces, no experience with common productivity applications and limited mindset of how computers might be used to automate various activities. Potential adopters of technological innovations are more likely to adopt the technology if they have been allowed to experiment with it

and have become more comfortable with it (Tan and Teo, 2000). The introduction/exposure to technology must happen gradually in a non-intimidating fashion.

Cultural Awareness

The second factor to bridge the "mindshare" divide is cultural awareness. The environment in developing countries is such that ICT's are resisted by users due to the skills shortage and also from the fear of the yet "unknown" changes that may result from the ICT use. This gap between the technologies/systems and the cultural context in which it is being introduced must be bridged. Awareness and commitment on the part of the users play an important part in ICT success (Dada, 2006). Individuals adopt an innovation over time and the longer the exposure and familiarity the better the perceptions and attitudes towards the technology and its usage (Rashid and Gloeckner, 2008). Only then can the users envision something that is different from their day to day reality. Through cultural awareness, users in the developing countries must be given exposure to images of the technology rich lifestyle that exists in the developed world. .

Systems Blending

Finally suitable adaptations of the systems are necessary to support the unique infrastructure and economics in developing countries. Lucas (2006) describes the concept of "blending", where systems are adapted to work with traditional technologies such as radio and telephone to allow an existing ICT to be utilized in a developing country. Blending can increase the match of the system to the environment and reduce the costs of bringing the system to a wider audience, further the positive impact of the system, and enhance the likelihood that the gains potentially accrue in those communities without the need to build up new technology infrastructure. Without such modification, too often, inappropriate use is made of technology, which are not suitable for the infrastructure in developing countries (Peters, et.al., 2006). In such scenarios, adjustments in procedures or management methods, for example, might provide a better match of the system to the problem space and ensure the success of the information system than purely technological solutions.

RESEARCH MODEL (BASED ON TAM)

The technology acceptance model (TAM) is one of the most widely used models used in Information systems research to study the adoption and usage intensions of users of systems. TAM's roots are from the theory of planned behavior and the theory of reasoned action (Ajzen, 1988; Ajzen, 1991). TAM was developed by Davis (1989) to explain the determinants of the intention to use computer systems. Two key components were used in the original model – perceived usefulness an the perceived ease of use of any technology innovation. Perceived usefulness is referred to as the "degree to which a person believes that using a particular system will enhance their performance" (in a job or activity). The perceived ease of use defines the "degree to which a person believes that using a particular system would be free of effort". It is posited in the original TAM that actual intention to use a system will positively depend on both of these constructs. TAM has been validated over a wide category of information systems and user domains and proven to give reliable and valid results (Venkatesh, et. al., 2003).

Researchers have extended TAM with other socio-technical constructs, such as computer self-efficacy, enjoyment and modeled their impact on intention to use through the TAM variables (Agarwal and Karahanna, 2000; Davis, 1993). Researchers have introduced subjective norm (SN), such as social influence into the Technology Acceptance Model (TAM) for its application to real world organizations (Madon, 2000; Malhotra and Galletta, 1999). The construct of social influence is operationalized in terms of certain factors (internalization, identification and compliance) and field data provided evidence of the reliability and validity of the proposed constructs, factor structures and measures. Musa, et. al. (2005) added external variables of Accessibility and Exposure to Technologies (AET) and Perceptions of Socio-economic Environment (PSEE) to extended TAM in a study of technology adoption in Sub Saharan Africa.

TAM provides a suitable framework for this research study to extended and develop a model to incorporate a measure of the above three socio-technical factors and measure their impacts on the intension to use the candidate information systems among users in a developing country. The research model is presented in Figure 2.

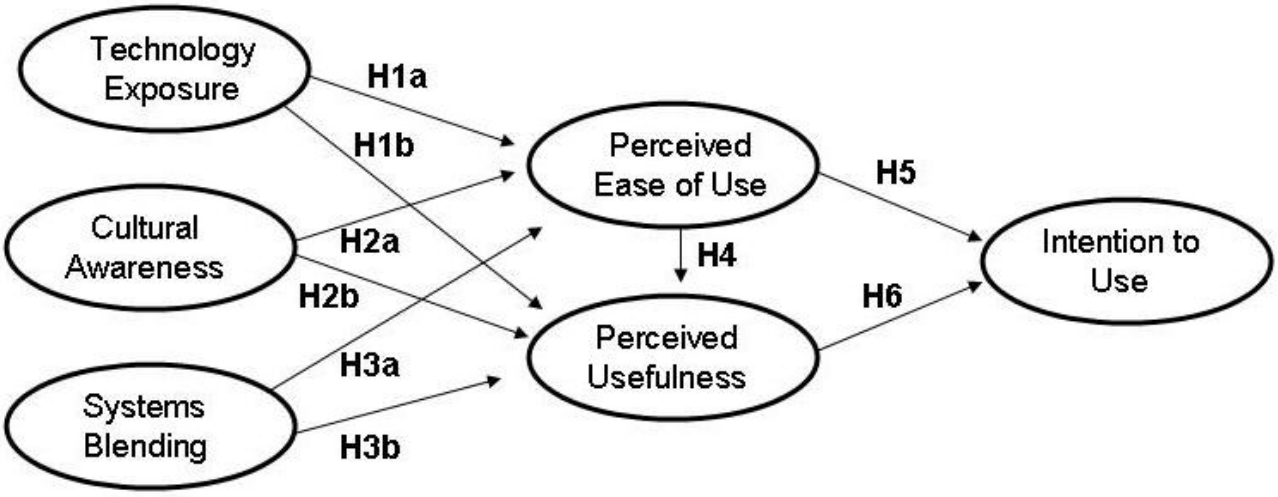

Figure 2: Research Model

RESEARCH HYPOTHESIS

User needs and systems development plans need to be aligned to allow for the most effective systems development. By investing in the three stated factors and avoiding a wholesale transposition of the information system from the developed world to a new and grossly different environment in a developing country, the intention to use outcome can be raised.

Hypothesis H1a/H1b

By increasing the exposure to technology on the user side, basic computer illiteracy can be addressed. Taylor and Todd (1995) confirmed moderating effects of computer experience on determinants of IT usage. Thompson et al. (1994) found prior technology experience to moderate the effects of social/cultural norms on computer utilization. In a study of IT usage in Nigeria, Anakwe, et.al. (1999) found that prior computer experience and having learned to use computers will tend to increase their further use. Rashid and Gloeckner (2008) investigated the diffusion of Information Learning Technologies among career educators in Malaysia and found that members who owned a personal computer scored lower on barrier to use and higher in usage, knowledge and satisfaction. They reported that such faculty members had less computer anxiety and demonstrated positive attitudes towards the technology.

Individuals in a social system adopt an innovation over time and the longer the exposure and familiarity the better the perceptions and attitudes towards the technology and its usage. Only through accessing the nature of the ICT can a potential user develop a perceived need for the innovation. Hence hypotheses H1a and H1b are stated as:

Hypothesis H1a: Technology Exposure will positively impact the perceived ease of use of the information system.

Hypothesis H1b: Technology Exposure will positively impact the perceived usefulness of the information system.

Hypothesis H2a/H2b

Perceptions and the adoption of technology is often shaped and constrained by the sub cultural dynamics of the users (Orlikowski, 1992; Sharma and Yetton, 2003). The extent to which potential users can have favorable or unfavorable view of behaviors/changes induced by the use of ICT can influence the perceived adoption of the technology (Hinson and Boateng, 2007). Many potential users in developing countries have strong reliance on entrenched business practices that rely on face to face interactions and view technology usage as a barrier to such personal contact. Examples include entrenched firms in the Brazilian real estate industry, who are heavily vested in face to face customer interactions even shun using phone calls (Nelson and Vasconceles, 20008). Individuals in rural and semi rural communities are more averse to technology usage than in the urban centers where potential users can be more open to new ideas. In a study of website usage among tourism firms in Ghana, despite all the benefits of ICT and the internet, Hinson and Boateng (2007) found that many small businesses have failed to embrace ICT due to factors such as lack of knowledge and familiarity.

What is necessary is to increase the internal readiness of the potential users by equipping them with insights through cultural awareness. Awareness and commitment on the part of the users play an important part in ICT success and the individual

user's perception of the system as contributing an improvement in their life (Dada, 2006). Through cultural awareness among the users of how technology has impacted society in developed countries the perceptions of the system's ease of use and usefulness can be increased. The cultivation of new cultures of ICT use can be demonstrated by including ways of processing, analyzing and using data in systems (Heeks, 2002). Cultivation is a gradual yet progressive process involving changes based on learning through viewing, internalizing and using ICT's. Hence hypotheses H2a and H2b are stated as

Hypothesis H2a: Cultural Awareness will positively impact the perceived ease of use of the information system.

Hypothesis H2b: Cultural Awareness will positively impact the perceived usefulness of the information system.

Hypothesis H3a/H3b

Research and published reports suggest that IT Infrastructure across and within developing nations can vary greatly. Systems need to account for rough conditions and not be designed with components that have low tolerance to environmental variables that can fail. For example Bhatnagar and Schware (2000) describe how some expensive, high quality, imported and totally automated equipment to measure butterfat content in milk at collection centers in India functioned poorly in Indian conditions. As a result, they were replaced with local made computer-based assessing equipment that was less sophisticated, less expensive, partially automated and requiring some human intervention, which nonetheless produced accurate butterfat readings in a few minutes. The later accounted for the local environment and functioned better in those conditions.

When the systems developer is given information about the nature of the infrastructure in the developing country, they can customize the information system to suit the major challenges through "blending" arrangements in systems deployment. Lucas (2005) describes the concept of "blending", where systems are adapted to work with traditional technologies such as radio and telephone to allow an existing ICT to be utilized in a developing country. Blending can increase the match of the system to the environment and reduce the costs of bringing the system to a wider audience, further the positive impact of the system, and enhance the likelihood that the gains potentially accrue in those communities without the need to build up new technology infrastructure. Without such customizations, too often, inappropriate technologies, which are not suitable for the infrastructure in developing countries is deployed (Peters, et. al., 2006), resulting in lower perceived usefulness and ease of use. Hence hypotheses H3a/H3b are stated as

Hypothesis H3a: Systems Blending will positively impact the perceived ease of use of the information system.

Hypothesis H3b: Systems Blending will positively impact the perceived usefulness of the information system.

Hypothesis H4/H5/H6

These three hypotheses come directly from the TAM model (Davis, 1989) and can be stated as below. These three hypotheses will also be tested in the environment of developing countries.

Hypothesis H4: Perceived ease of use of the information system will positively impact the perceived usefulness of the information system.

Hypothesis H5: Perceived ease of use of the information system will positively impact the Intention to use.

Hypothesis H6: Perceived usefulness of the information system will positively impact the Intention to use.

METHODOLOGY AND DATA COLLECTION

The methodology involved interviews to ground the research model and then a survey to collect quantitative data to statistically test the model and the hypothesized relationships.

Small businesses predominate the Indian Retail sector – 44 million non agricultural businesses, 36% sole proprietorships and 64% have fewer than 6 employees (National Sample Survey Organization, 2000). Recently large global retailers have set up backend distribution outlets to support the small retail stores in urban centers of India. The data collection is from the evaluation of an information system to automate the ordering process between such large backend distribution centers and the small retailers in an urban area in India.

Phase I - Interviews

In the first phase of this research, a set of interviews were conducted with targeted retail store owners and systems analyst/development staff of a wholesale consumer products ordering system being deployed among a less developed and technologically backward group of small retail business owners in India. A total of 8 retail business owners and 2 systems

analysts researching the requirements of an ordering system were interviewed. The 10 interviewees were drawn using a convenience sample through business contacts. The following questions were posed in semi-structured interviews:

1. Store Owners: How do you currently procure items for your store?
2. Store Owners: Can you describe how a computer may assist you in the procurement process?
3. System Analysts: What have you learned from working in the Indian sub continent?

A subset of interview quotes are presented below in Table 1 and confirm the problems related to the "mindshare" divide.

"Mindshare" Issue	Potential Users (8)	Systems Staff (2)
Lack of understanding of how to use technology	*"It is very difficult for me to type everything in all the places to enter my values." I just want to turn a page or use a chit of paper and write my order.*	
Lack of Exposure to Technology	*"Gadgets are not part of our life; We do not even use a calculator. An accounting notebook is something I can always keep locked up and safe with me. Will a computer be as convenient?"* *"My store is only 10 square meters, where will I place a computer?"*	
Lack of common language & Terms	*"Too many terms that I can not understand – USB, Wifi"*	
Systems Promoters have hidden agendas	*"Why do we have to place orders with only this one store through this system, when in the "burrabazar" we can negotiate with 5 sellers?"*	
No Exposure to radically different Cultures	"I want to go and have tea and discuss the business with my supplier and see what he suggests to me".	*"I had no idea that one computer could be used by 30 users. Our authentication uses cookies, which cannot apply among other things!" Delivery concept will not work here"*
No understanding of unique Infrastructure		*"We seriously did not realize how often there is power cuts until we visited the country "*

Table 1. Interview Data

Phase Two

A second phase of this study will collect field data using a survey, which is being developed to collect empirical data from the small retail business owners and will assess the impact of the three factors on the perceived usefulness, ease of use and intention to use of the proposed information system.

CONCLUSION

New information and communications technologies can lead to improved livelihoods, increased knowledge and more productivity. Recent gains in advancing human development and eradicating poverty have come largely from technological breakthroughs, which enhance the health of people and make them more educated and productive (UN, 2001).

There are severe disparities in the sheer number of IT stock across developing and developed countries; such as per capita computers, internet access, computer usage, etc. However, a significant issue is not so much about the deployed stock of digital technology but rather about the resulting lack of IT literacy that can severely limit the benefits derived from such

technologies, even when access is provided. It is clear that technology solution providers ignore the developing countries and the nuances of those users and environments, when designing systems. This paper describes an ongoing study to evaluate the impact of three factors to alleviate the "mindshare" divide among users in developing countries. This research paper proposes three facilitating factors – (i) Technology Exposure, (ii) Cultural Awareness and (iii) Systems Blending to increase the effectiveness of systems in developing environments. The paper extends the Technology Acceptance Model (TAM) to measure the impact of each of these three factors on the system adoption outcome.

Contributions and Implications

The paper attempts to categorize an underlying problem faced when designing, developing and deploying information systems in developing countries. In additional the paper describes three factors that can be used to alleviate this mindshare divide between the users and the systems staff. The paper extends the technology acceptance model with constructs that measure the factors when used as interventions in the systems development lifecycle. The extension of the TAM model and the validation of this extended TAM for developing countries along with description of the three factors stand as significant contributions of this paper.

The second phase of data collection will attest to whether the digital mindshare divide can be alleviated by addressing the three factors. Additionally, the research project is developing the content of the presentations and video for the technology exposure and cultural awareness for the users/systems staff.. Researchers/Practitioners may utilize the content as well as the extended TAM model for additional studies or practical system implementations in developing countries.

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